



launcher. To ensure safety for the operator, the missile then coasts for a time before the second stage fires, well clear of the mouth of the launch-tube. To guide it to the target, the operator has only to keep the target centred in a telescopic sight.

Firing trials began in 1965, and production in November 1968. Deployment to US Army units in the USA and Europe was started in November 1970, and the missile's effectiveness was demonstrated in Vietnam in 1972. An infra-red sight has been developed to permit use of TOW at night. TOW was also used very successfully in an air-to-surface role in Vietnam in 1972, from some of the eight Bell AH-1G HueyCobra helicopters modified under the Improved Cobra Armament Program. Because of the

Above: Agusta 109 helicopter carrying TOW missiles.

temperatures and altitudes encountered in that war zone, the aircraft proved able to carry only two to six TOWs, with a gyro-stabilised sight, instead of the full planned complement of eight TOWs. However, a further 290 AH-1Gs are being modified to similar AH-1Q TOW/Cobra standard for the US Army, and delivery of these began in June 1975. Orders for over 275,000 TOW missiles have been placed by the US Army, US Marine Corps and the armed services of other countries. Of these more than 223,000 have been delivered. All TOW missiles delivered since mid-1976 have a range of 12,300ft (3,750m).

Trident

Underwater-to-surface ballistic missile. In production and service.

Prime contractor: Lockheed Missiles and Space Company

Powered by: Hercules/Thiokol solid-propellant motors

Airframe: Three-stage missile. Cylindrical body with ogival nose-cone. Retractable Aerospike in nose. No fins or wings

Guidance and Control: Inertial guidance

Warhead: Thermonuclear, in multiple independently targetable re-entry vehicles

Length: 34ft 0in (10.36m)

Body diameter: 6ft 2in (1.88m)

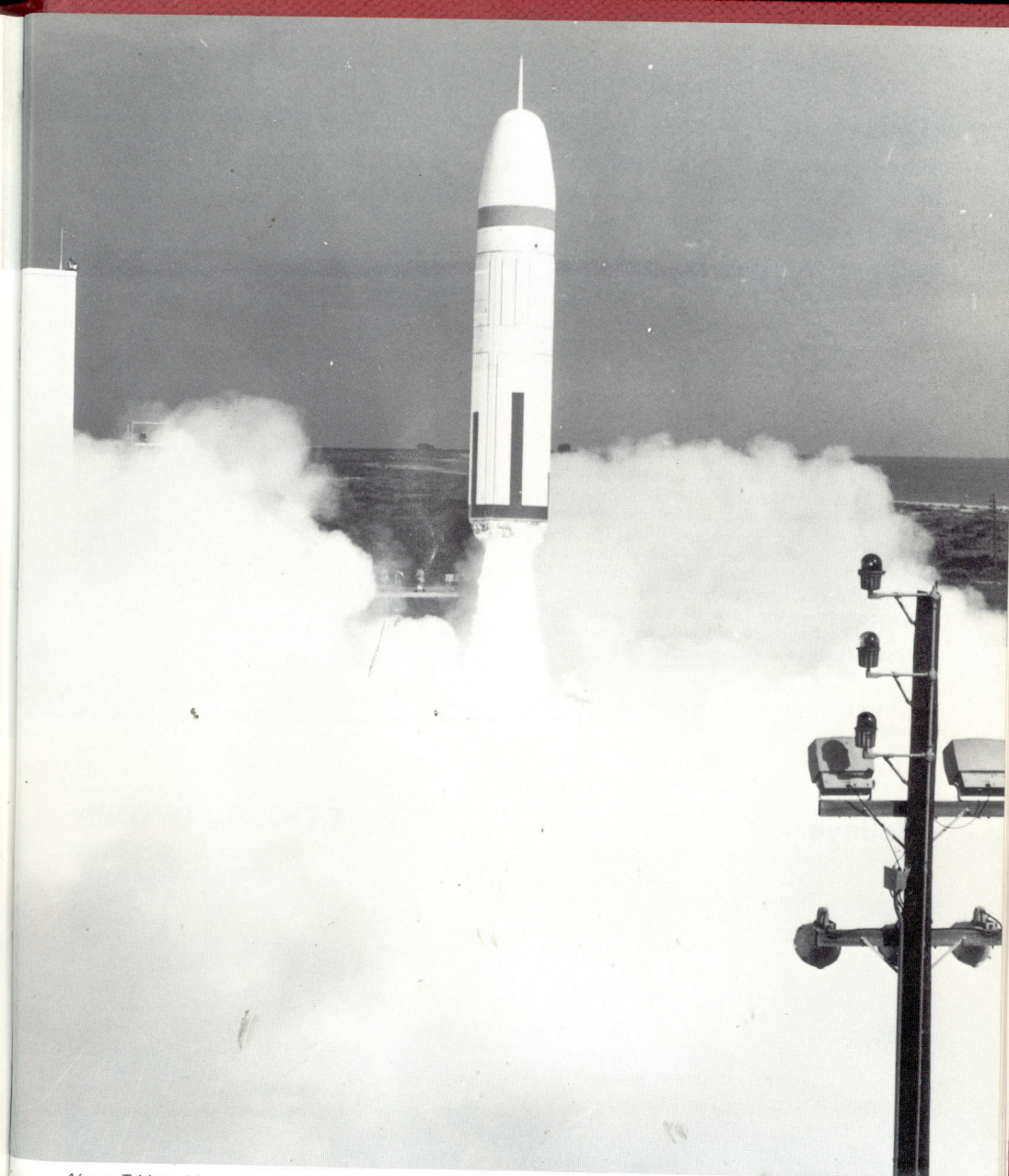
Launch weight: 65,000lb (29,480kg)

Max range: 4,600 miles (7,400km)

USA

Development and Service

The Trident 1 (C4), formerly called ULMS (Undersea Long-range Missile System), has been under development for some years as a third-generation follow-on to Polaris and Poseidon. The missile's range will make the carrier-submarines much more difficult to locate and track, by extending immensely the area of ocean in which they can patrol and still be within range of their designated targets. Trident missiles can be launched from a submerged or surfaced submarine. The missile is being installed in 10 of the present Poseidon submarines and will be installed in the new 24-tube Trident submarines, the latter of which will have better command and control systems and sonar than previous fleet ballistic missile (FBM) submarines. Altogether, 13 Ohio class Trident submarines will be built.



Above: Trident 1 launch.

Development of the Trident 1 (C4) was awarded to Lockheed in 1974. The first missile launch was made from Cape Canaveral on 18 January 1977,

and by early 1978 12 flight tests had taken place, all but one successfully. Operational deployment of the Trident 1 in the modified Poseidon submarines was expected to begin in late 1979. Deployment of Trident 1 missiles in Ohio submarines is not expected until 1981 at the earliest.

Development is continuing on a Trident II missile of much improved accuracy and greater warload, which could be operational in the latter 1980s, and on the Mk 500 Evader manoeuvring re-entry vehicle (MARV) to elude advanced Soviet ABMs.

US Roland

**Close-range surface-to-air missile.
Under development.**

Prime contractor: Hughes Aircraft Company

Development and Service

US Roland is an American licence-produced version of the Euromissile Roland. It is a close-range air defence system which can protect stationary vehicles or emplacements and moving columns and armoured units against high-speed low level air attack during day or night and in virtually any weather condition. The missiles and approximately 90% of the field replaceable parts are interchangeable with those of the Euromissile counterparts, the main difference between the two systems being that the US version has a modified tracking radar. All prime mission equipment is housed in a helicopter-transportable fire unit module which will normally be mounted on the US Army's M-109 tracked vehicle, although the system can be trailer-mounted or placed in ground positions. Test firings at the White Sands Missile Range, New Mexico, began in early 1978; by October 45 missiles had been launched, 34 of which were completely successful and five partially successful.

Right: US Roland test launch at White Sands Missile Range.



USA

Walleye



USA

Air-to-surface 'glide bomb'. In service.

Data: Walleye 1

Prime contractor: Martin Marietta Corporation

Airframe: Cylindrical body, with tapering tail-cone and glass-tipped ogival nose. Rear-mounted cropped-delta cruciform wings, each with trailing-edge control surface

Guidance and Control: Self-homing TV guidance system. Control by aerodynamic surfaces on wings

Warhead: High-explosive, Mk 1 Mod 0.850lb (385kg)

Length: 11ft 3in (3.44m)

Body diameter: 1ft 3in (0.38m)

Wing span: 3ft 9in (1.14m)

Launch weight: 1,100lb (500kg)

Development and Service

Although Walleye is unpowered, it was once described by the US Navy as the most accurate and effective air-to-surface conventional weapon ever developed anywhere. The Naval Weapons Center at

China Lake, California, was responsible for its development, the idea being to produce a 'smart bomb' that would find its own way unerringly to the target after the launch aircraft had turned for home. Martin Marietta received their first production contract in January 1966, their assembly lines being supplemented by others at Hughes Aircraft Company for a period, to meet the demands of the war in Vietnam. Development of a Walleye 2 version by Martin Marietta began in the spring of 1971. This version has a warhead in the 2,000lb (907kg) range and is some 2ft (60cm) longer than the original version. It is also in service. The latest version is Extended-Range, Data Link Walleye II, which has larger wings and data link equipment. Walleye Is and IIs are being modified to the latest standard.

Walleye is carried by a variety of aircraft including the A-4, A-6, A-7 and F-4.

Before launch, the pilot focuses the missile's TV camera on the target, with the aid of a TV monitor screen in the cockpit. Once the camera has been locked on to the target, mechanism inside the Walleye takes over, 'watching' a screen inside the bomb and correcting any deviation from the flight path to the target during the bomb's unpowered descent.

Below left: Walleye on an A-4 Skyhawk.

PHOTO CREDITS

Associated Press 98, 101
Dr A. Beaumont 68(T)
ECP Armées 125, 126, 127(L)
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United Press 117
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